

The genera *Mouffetina* Frey and *Trichosia* Winnertz (Diptera, Sciaridae) in Japan with a key for the Japanese species and an updated world checklist

Mitsuaki Sutou¹, Frank Menzel²¹ Graduate School of Arts and Sciences, The University of Tokyo, Meguro-ku, 153-8902 Tokyo, Japan² Senckenberg Deutsches Entomologisches Institut, Eberswalder Straße 90, 15374 Müncheberg, Germany<https://zoobank.org/D61E1FAE-34D3-4565-AE68-C0F3C265566F>

Corresponding author: Mitsuaki Sutou (mi.sutou@r8.dion.ne.jp)

Academic editor: Thomas Schmitt | Received 30 December 2024 | Accepted 10 February 2025 | Published 14 March 2025

Abstract

Taxonomy of the genera *Mouffetina* Frey and *Trichosia* Winnertz of black fungus gnats in Japan is studied. Seven new species, *M. duopalpus* **sp. nov.**, *T. stylofornix* **sp. nov.**, *T. fumoranea* **sp. nov.**, *T. basiconstricta* **sp. nov.**, *T. paraborealis* **sp. nov.**, *T. comprimera* **sp. nov.**, and *T. montaclaria* **sp. nov.** are described, and six species *T. scotica*, *T. conglobata*, *T. acrotricha*, *T. hypertricha*, *T. lengersdorfi* and *T. edwardsi* are newly recorded from Japan. This study records the species of *Mouffetina* from Japan for the first time, and increases the number of known Japanese *Trichosia* from only one species to thirteen species. Intraspecific morphological variability of the widely distributed species is discussed. The larva of *T. conglobata* is described in detail, and its morphology compared with larvae of other genera of black fungus gnats. Updated world checklist is attached to overview the diversity of the members of these genera.

Key Words

Black fungus gnats, larval morphology, new combinations, new records, new species, taxonomy

Introduction

Trichosia Winnertz, 1867 is one of the genera of black fungus gnats (family Sciaridae). The members of this genus are mostly medium-sized species (2–6 mm) which have a blackish body and hyaline or fumous wings (Figs 4, 5G). This genus was established by Winnertz (1867) together with the descriptions of three new species *T. splendens*, *T. absurda* and *T. modesta*. Subsequently Coquillett (1910: 616) designated *T. splendens* Winnertz, 1867 as the type species of the genus. The other two species described by Winnertz (1867) are currently placed in different genera: *T. absurda* Winnertz, 1867 was synonymized with *Leptosciarella hirtipennis* (Zetterstedt, 1838) (Mohrig and Menzel 1997) and *T. modesta* Winnertz, 1867 was transferred to the genus *Sciara* Meigen (Tuomikoski 1960) and is identical

to *S. hebes* (Loew, 1869) (Mohrig et al. 2013). Recent taxonomic studies on Palaearctic black fungus gnats (Menzel and Mohrig 1997; Menzel and Mohrig 2000) revised the diagnosis of the genus *Trichosia* and recognized the following three extant subgenera: *Trichosia* Winnertz s. str., *Baeosciara* Tuomikoski and *Mouffetina* Frey. This classification was also followed in the revision of North American Sciaridae by Mohrig et al. (2013). The subgenus *Baeosciara* was originally described as a genus, and some authors maintain this rank in the sense of Tuomikoski (1960) (e.g., Vilkamäa 2003; Rudzinski 2005). The present study treats *Baeosciara* as a subgenus following the studies cited above (Menzel and Mohrig 1997; Menzel and Mohrig 2000; Mohrig et al. 2013). The recent systematic study based on molecular data (Shin et al. 2019) showed that *Mouffetina* is placed at a different clade from that consisting of *Trichosia*

s. str. and *Baeosciara*, and raised *Mouffetina* to the genus rank. Following this proposal (Shin et al. 2019), we treat *Mouffetina* as an independent genus.

The genera *Mouffetina* and *Trichosia* is mainly distributed in the Holarctic region and currently include 25 Palaearctic species (Menzel and Mohrig 2000; Vilkamaa 2003; Menzel and Heller 2006; Heller et al. 2016) and eight Nearctic species (Vilkamaa 2003; Mohrig et al. 2013). Among them, the three species *M. expolita* (Coquillett), *T. diota* (Garrett) and *T. scotica* (Edwards) have a Holarctic distribution. Rudzinski (2005) recorded seven species of *Trichosia* from Taiwan including *T. scotica* (Edwards). Although 36 extant species and 10 fossil species in amber of these genera are known worldwide (see updated checklist), only one species *T. caudata* (Walker) [formerly *T. morio* (Fabricius) *sensu* Menzel and Mohrig (2000) (Heller et al. 2016)] has been recorded from Japan (Sasakawa 1993, 2003, 2014). The present study increases the knowledge of these genera in the Japanese fauna. The recent molecular phylogenetic analyses of Sciaridae placed the genus *Trichosia* (s. str.) in the subfamily Sciarrinae (Shin et al. 2013, 2019; Vilkamaa et al. 2018, 2023; Arthofer et al. 2021). Shin et al. (2019) placed the genus *Mouffetina* in the subfamily Chaetosciarinae.

Adults of *Trichosia* usually occur in forests, but sometimes they are found in open habitats such as grasslands (Menzel et al. 2006; Menzel and Schulz 2007; Vilkamaa et al. 2007). They frequently emerge from rotten wood, which indicates that the larvae are xylophagous (Tuomikoski 1957; Irmeler et al. 1996; Menzel et al. 2006). However, a few species of this genus have different larval habitats. For example, adults of *Trichosia* (*Baeosciara*) *sinuata* were reared from bracket fungus (Vilkamaa and Komonen 2001). Shin et al. (2013) showed that dead plant material (plant litter, rotten wood) represents the ancestral larval habitat of the Sciaridae.

Material and methods

Specimens of adults were collected by sweep-net, aspirator, emergence traps, flight interception traps, Malaise traps or by rearing larvae and pupae to imago. They were preserved in 70–80% ethanol except for the following two pinned and dried specimens: a male of *T. hypertricha* and a male of *T. edwardsi* (see examined specimens of each species). Specimens from ethanol were mounted on microscopic slides with xylol-based Canada Balsam after treatment in pure ethanol and cresote oil for dehydration. For dried specimens, genitalia were dissected and macerated in 10% KOH solution and were temporarily mounted on glass slides in glycerol. Larvae and pupae were also preserved in 70–80% ethanol. Heads of some larvae were dissected and were gently macerated with lactic acid for morphological examination. Drawings were made using a compound microscope and camera lucida. Terminology for adult morphology follows Mohrig et al. (2013). Examined specimens are deposited in the following institutions and private collection.

NSMT	Department of Zoology, National Museum of Nature and Science, Tsukuba, Japan
KPMNH	Kanagawa Prefectural Museum of Natural History, Odawara, Japan
MZH	Zoological Museum, Finnish Museum of Natural History, Helsinki, Finland
PCMS	Private collection of the author (MS), Tokyo, Japan.
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany

Results

Key to the Japanese *Mouffetina* and *Trichosia* species (males)

1	Gonostylus slender, 2.4–2.6 times as long as wide (Fig. 2B)	<i>T. (B.) scotica</i> (Edwards, 1925)
–	Gonostylus relatively broad, 1.4–2.2 times as long as wide	2
2	Spines of gonostylus closely packed on its apical part (Fig. 1D), palpus 2-segmented (Fig. 1B)	<i>M. duopalpus</i> sp. nov.
–	Spines of gonostylus arranged sparsely on its apex or inside, palpus mostly 3-segmented but sometimes 2-segmented due to intraspecific morphological variation (see discussion)	3
3	Inside of dorsal surface of gonostylus with an arcuate concavity (Fig. 3D)	<i>T. (T.) stylofornix</i> sp. nov.
–	Inside of dorsal surface of gonostylus without concavity	4
4	Gonostylus with distinct inner process on which many spines are present (Figs 5D, 6D)	5
–	Gonostylus without inner process	6
5	Wing membrane with numerous macrotrichia and minute pits in which bases of macrotrichia are embedded (Figs 4B, 5F)	<i>T. (T.) fumoranea</i> sp. nov.
–	Wing membrane bare	<i>T. (T.) basiconstricta</i> sp. nov.

6	Spines on inside of gonostylus separated into two groups (Fig. 7B)	<i>T. (T.) conglobata</i> Rudzinski, 2005	7
–	Spines on inside of gonostylus evenly separated from each other or form a single group		
7	Small species, male body size 2.3–2.8 mm	<i>T. (T.) paraborealis</i> sp. nov.	8
–	Medium-sized species, male body size more than 3.0 mm		
8	Gonostylus approximately 1.8–2.0 times as long as wide		9
–	Gonostylus approximately 1.5–1.6 times as long as wide		12
9	Inside of gonostylus nearly flat with 5–6 spines	<i>T. (T.) acrotricha</i> Tuomikoski, 1960	10
–	Inside of gonostylus slightly swollen with 5–6 spines		
10	Upper part of inside of gonostylus with dense setae (Fig. 9C)	<i>T. (T.) comprimera</i> sp. nov.	11
–	Upper part of inside of gonostylus without dense setae		
11	Distal part of wing membrane with macrotrichia, spines on inside of gonostylus slightly directed downward	<i>T. (T.) caudata</i> (Walker, 1848)	
–	Distal part of wing membrane with several macrotrichia or bare, spines on inside of gonostylus almost horizontal	<i>T. (T.) lengersdorfi</i> Heller, Köhler & Menzel, 2016	
12	Distal half of wing membrane with microtrichia	<i>T. (T.) hypertricha</i> Menzel & Mohrig, 1997	13
–	Wing membrane bare		
13	Inside of gonostylus with 5–6 sparsely arranged spines	<i>T. (T.) edwardsi</i> (Lengersdorf, 1930)	
–	Inside of gonostylus with 6–7 spines forming a group, each spine relatively short (Fig. 10D)	<i>T. (T.) montaclaria</i> sp. nov.	

Descriptions

Mouffetina duopalpus sp. nov.

<https://zoobank.org/8140FF5F-E97B-486F-B3C8-186CF3EFB1F8>

Fig. 1A–D

Type material. Holotype. JAPAN • ♂; Honshu, Tochigi Pref., Nikko, near lake Yuno; 36°48'N, 139°26'E; alt. 1500 m; 18 June 2000; K. Uesugi leg.; NSMT.

Description. Male. Head: Eye bridge four facets wide. Prefrons with many setae and clypeus bare. Scape brown with 3 anterior setae, pedicel brown with many setae; flagellomeres brown; 4th flagellomere 2.6 times as long as wide, neck portion about 1/8 of its whole length (Fig. 1A), hairs yellow and almost as long as its width. Palpus yellowish brown, 2-segmented, 1st segment with 4 setae on its outside and with distinct brownish sensory area bearing minute sensilla, 2nd segment with 6 setae (Fig. 1B). Thorax: Color predominantly brown with dorsocentral and dorsolateral setae on mesonotum; scutellum with many setae; posterior pronotum with setae. Legs predominantly yellowish brown; fore tibial spur about 1.2 times as long as width of tibial apex. Wing membrane bare; distal 2/3 of R5 with both dorsal and ventral macrotrichia, bM bare, r-m with several dorsal macrotrichia, M1, M2, and CuA1 with dorsal macrotrichia, stem of M bare; length of R1 = 1.3 R, c = 0.8 w, r-m = 1.6 bM; stem of CuA very short, almost absent; R1 ending at same level of branching point of M1 and M2; wing length 4.1 mm. Halter brown, knob and distal

half of stalk with setae. Abdomen: Tergites and sternites brown with dark brownish setae. Gonocoxite slightly wider than long (Fig. 1C); gonostylus nearly semicircular in shape with 3 apical spines (Fig. 1D); tegmen trapezoidal with darkened border (Fig. 1C); aedeagus distinct (Fig. 1C). Body size: 3.4 mm.

Female. Unknown.

Remarks. The name of the new species refers to its 2-segmented palpus (Fig. 1B). This species is so far the only Japanese species placed in the genus *Mouffetina*. The new species resembles *M. expolita* (Coquillett) which is known from Norway, Far Eastern Russia, Canada, and USA (Alaska, Oregon) (Mohrig et al. 2013). The new species is distinguished from *M. expolita* by having few apical spines and a more gently curved outline of the gonostylus (Fig. 1D).

Trichosia (Baeosciara) scotica (Edwards, 1925)

Fig. 2A, B

Material examined. JAPAN • 12 ♂♂; Kyushu, Kumamoto Pref., Aso, Aso National Park, coniferous plantation of *Cryptomeria japonica*; 32°55'N, 131°06'E; alt. 700 m; 12–14 Oct. 1995; M. Jaschhof leg., aspirator and sweep-net; 9 ♂♂, SDEI; 2 ♂♂, PCMS; 1 ♂, MZH • 2 ♂♂; Honshu, Kanagawa Pref., Isehara, Mt. Oyama, Miharudai; 35°26'09"N, 139°14'31"E; alt. 800 m; 19 June 2006; M. Sutou leg., sweep-net; 1 ♂, SDEI; 1 ♂, PCMS • 4 ♂♂; Honshu, Hyogo Pref., Yabu, Mt. Hyounosen,

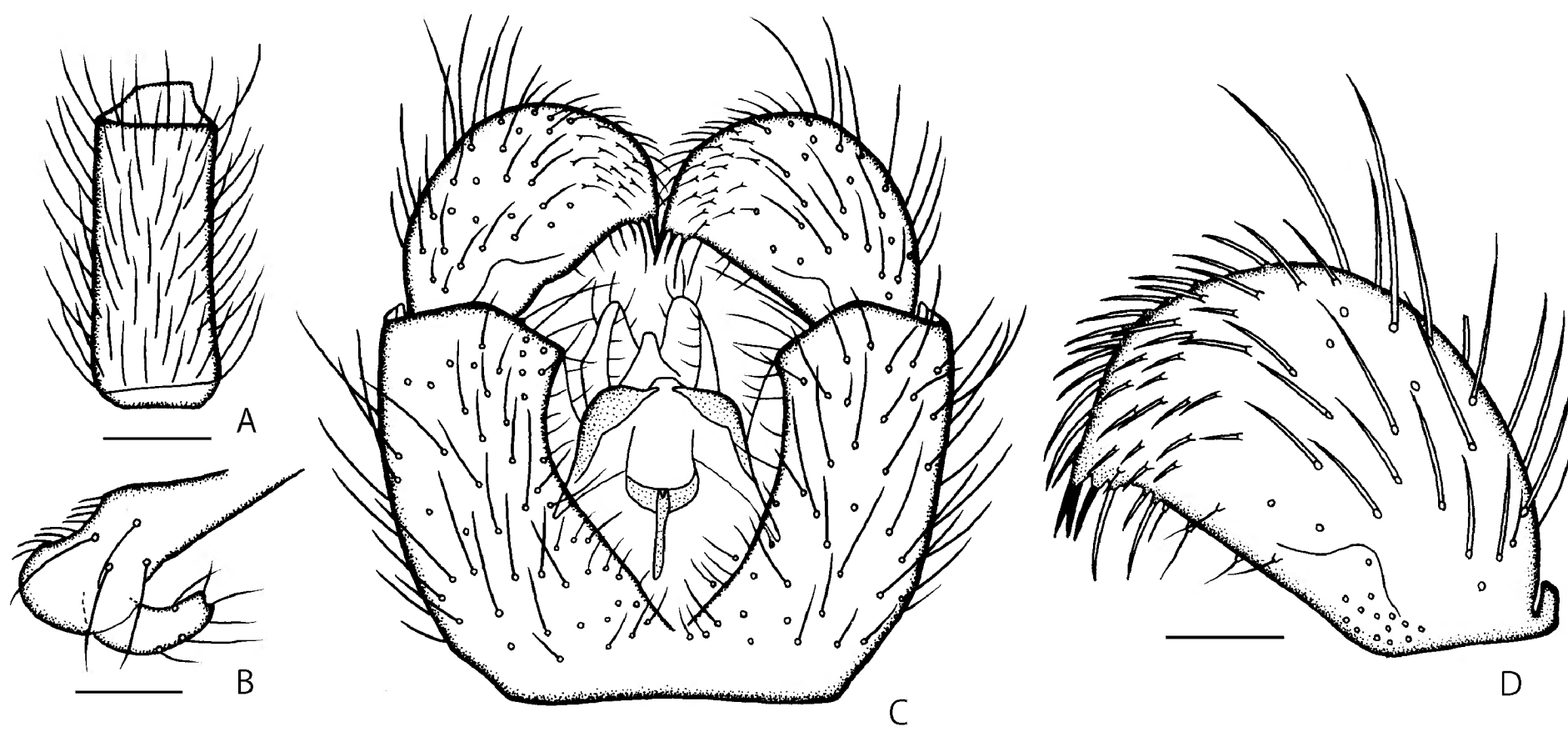


Figure 1. *Mouffetina duopalpus* sp. nov., male holotype. **A.** 4th flagellomere; **B.** Left palpus; **C.** Genitalia, ventral view; **D.** Right gonostylus, ventral view. Scale bars: 0.05 mm (**A**, **B**, **D**); 0.1 mm (**C**).

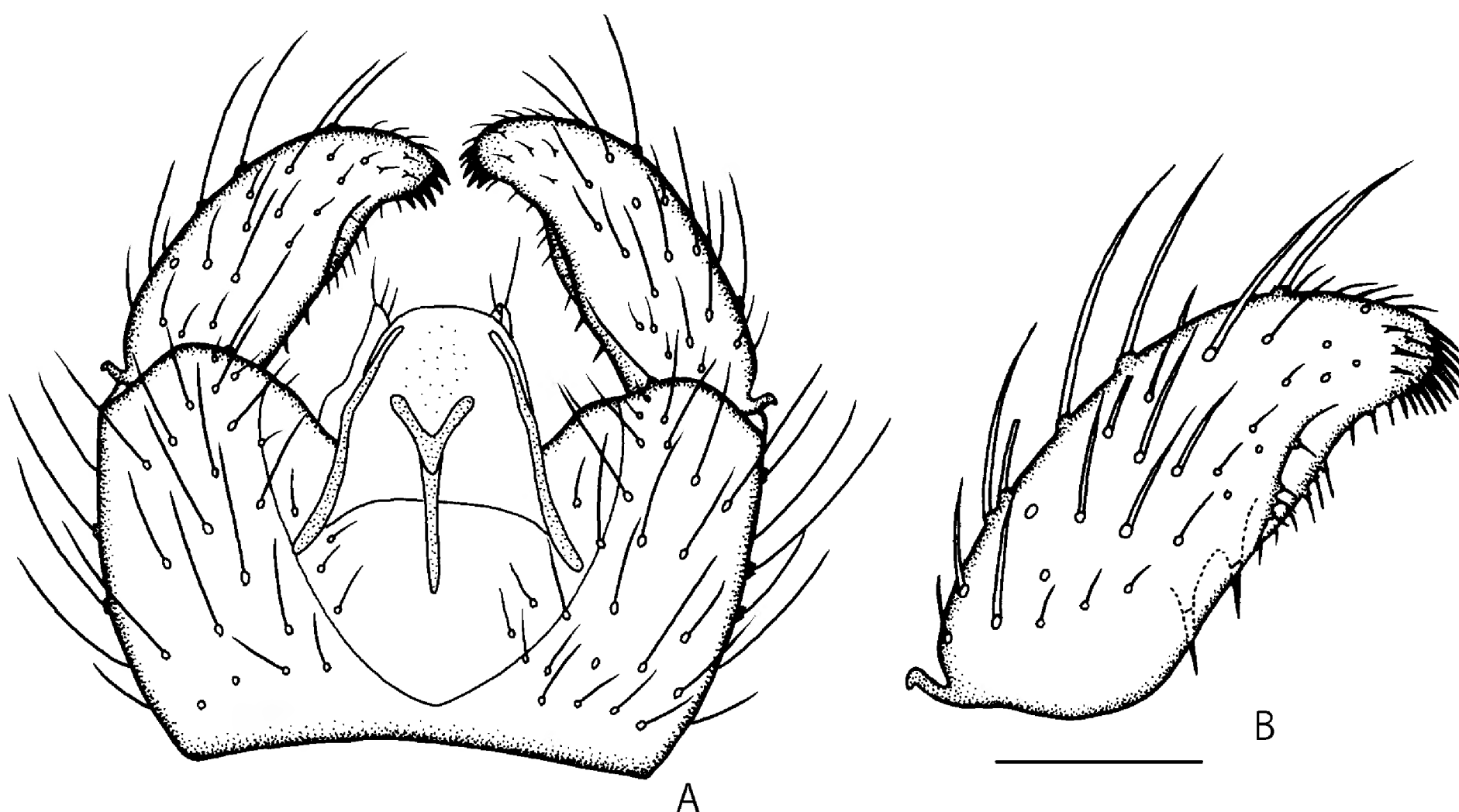


Figure 2. *Trichosia scotica* (Edwards), male. **A.** Genitalia, ventral view; **B.** Left gonostylus, ventral view. Scale bars: 0.1 mm (**A**); 0.05 mm (**B**).

mixed forest dominated by *Fagus crenata* and bamboo grasses; 35°21'N, 134°31'E; alt. 1200 m; 28 Sept. 1995; M. Jaschhof and T. Yagi leg., sweep-net; SDEI • 2 ♂♂; Honshu, Osaka Pref., Minoh, mixed forest, evergreen broad-leaved trees and *Cryptomeria japonica*; 29 Sept. 1995; M. Jaschhof leg.; SDEI • 1 ♂; Shikoku, Kochi Pref., Tosashimizu, Ashizuri Peninsula, Sata-yama Forest Reserve, primary evergreen broad-leaved forest dominated by *Castanopsis sieboldii*; 32°45'N, 133°00'E; alt. 300–400 m; 9 Nov. 1998; M. Jaschhof leg., sweep-net; SDEI • 1 ♂; same data but 10 Nov. 1998; SDEI • 1 ♂; Kyushu, Miyazaki Pref., Miyakonojo, Takazaki;

31°55'N, 131°03'E; alt. 200 m; 27 May 2002; M. Sutou leg., sweep-net; PCMS • 1 ♂; Kyushu, Kagoshima Pref., Kirishima, Makizono; 31°52'N, 130°45'E; alt. 240 m; 25 Oct. 1998; M. Sutou leg., sweep-net; PCMS.

Remarks. This species is widely distributed, and has been recorded from Europe (Menzel and Mohrig 1997; Vilkamaa 2003; Menzel et al. 2006), North America (Vilkamaa 2003; Mohrig et al. 2013), and Taiwan (Rudziński 2005). The present study reports the first record of this species from Japan. The gonostylus of this species has two characteristic mesal spines, which are moderately directed downward. These two spines tend to be more

widely separated each other in the Japanese specimens (Fig. 2B) compared to those of the specimens from the other regions.

***Trichosia (Trichosia) stylofornix* sp. nov.**

<https://zoobank.org/5719059F-8E55-4ADA-913C-E8080A594E93>

Fig. 3A–D

Type material. Holotype. JAPAN • ♂; Kyushu, Kumamoto Pref., Aso, Aso National Park, coniferous plantation of *Cryptomeria japonica*; 32°55'N, 131°06'E; alt. 700 m; 12–14 Oct. 1995; M. Jaschhof leg., aspirator and sweep-net; SDEI. **Paratypes.** JAPAN • 29 ♂♂; same data as for holotype; 23 ♂♂, SDEI; 2 ♂♂, NSMT; 2 ♂♂, PCMS; 2 ♂♂, MZH • 2 ♂♂; Honshu, Tokyo, Miyake Island, Hinoyama-touge; 34°06'N, 139°33'E; 5–7 Apr. 2010; J. Aoki leg., flight interception trap; SDEI.

Description. Male. Head: Eye bridge 2–3 facets wide. Prefrons with about 5 setae and clypeus bare or with a seta. Scape brown with about 5 setae anteriorly, pedicel brown with about 10 setae; flagellomeres brown, base of 1st flagellomere yellow; 4th flagellomere about 5.0 times as long as wide, neck portion about 1/8 of its whole length (Fig. 3A), hairs yellowish brown and longer than width of flagellomere. Palpus yellowish brown, 3-segmented with length ratio 1.8 : 1.0 : 2.1, 1st segment with 1–3 (mostly 2) setae on its outside and with indistinct sensory area bearing minute sensilla, 2nd segment with 6–7 setae, frequently one of them distinctly longer than the others, 3rd segment slender with about 10 setae (Fig. 3B). Thorax: Color predominantly brown; mesonotum with both short

and long setae; scutellum with at most 4 long setae and some short setae; posterior pronotum bare. Coxae, femora, and tibiae predominantly yellowish brown, tarsi brown; tibiae and basitarsi, especially hindtibia with differentiated spine-like short setae in ground setosity; fore tibial spur about 1.2 times as long as width of tibial apex. Wing with brownish anterior veins and light brownish posterior veins; wing membrane bare; distal 1/5–1/4 of R5 with both dorsal and ventral macrotrichia, bM, r-m, M1, M2, CuA1, and CuA2 with dorsal macrotrichia, stem of M bare or with several dorsal macrotrichia; length of R1 = 0.6–0.7 R, c = 0.7–0.8 w, r-m = 0.5–1.0 bM, stem of CuA = 0.3–0.7 bM; R1 ending slightly before branching point of M1 and M2; wing length 1.8–2.4 mm. Halter yellowish brown, knob and distal 1/4–1/3 of stalk with setae. Abdomen: Tergites and sternites brown with brownish setae, membrane between tergites and sternites yellowish brown. Gonocoxite wider than long (Fig. 3C); gonostylus longer than wide with apical spines, and inside of dorsal surface with arcuate concavity where 3–5 spines are present, 2 of them arranged parallel (Fig. 3D); tegmen membranous, wider than long with weakly sclerotized base (Fig. 3C); aedeagus nearly V-shaped (Fig. 3C). Body size: 1.9–2.9 mm.

Female. Unknown.

Remarks. This new species is distinctive in having long antennal flagellomeres (Fig. 3A). It also has unique structures of the gonostylus (Fig. 3D), and is named after the characteristic arcuate concavity of dorsal surface of the gonostylus (*'fornix'* means arch in Latin). The distribution of this species is so far restricted to Kumamoto, southwestern Japan, and Miyake Island, 175 km south of Tokyo metropolis.

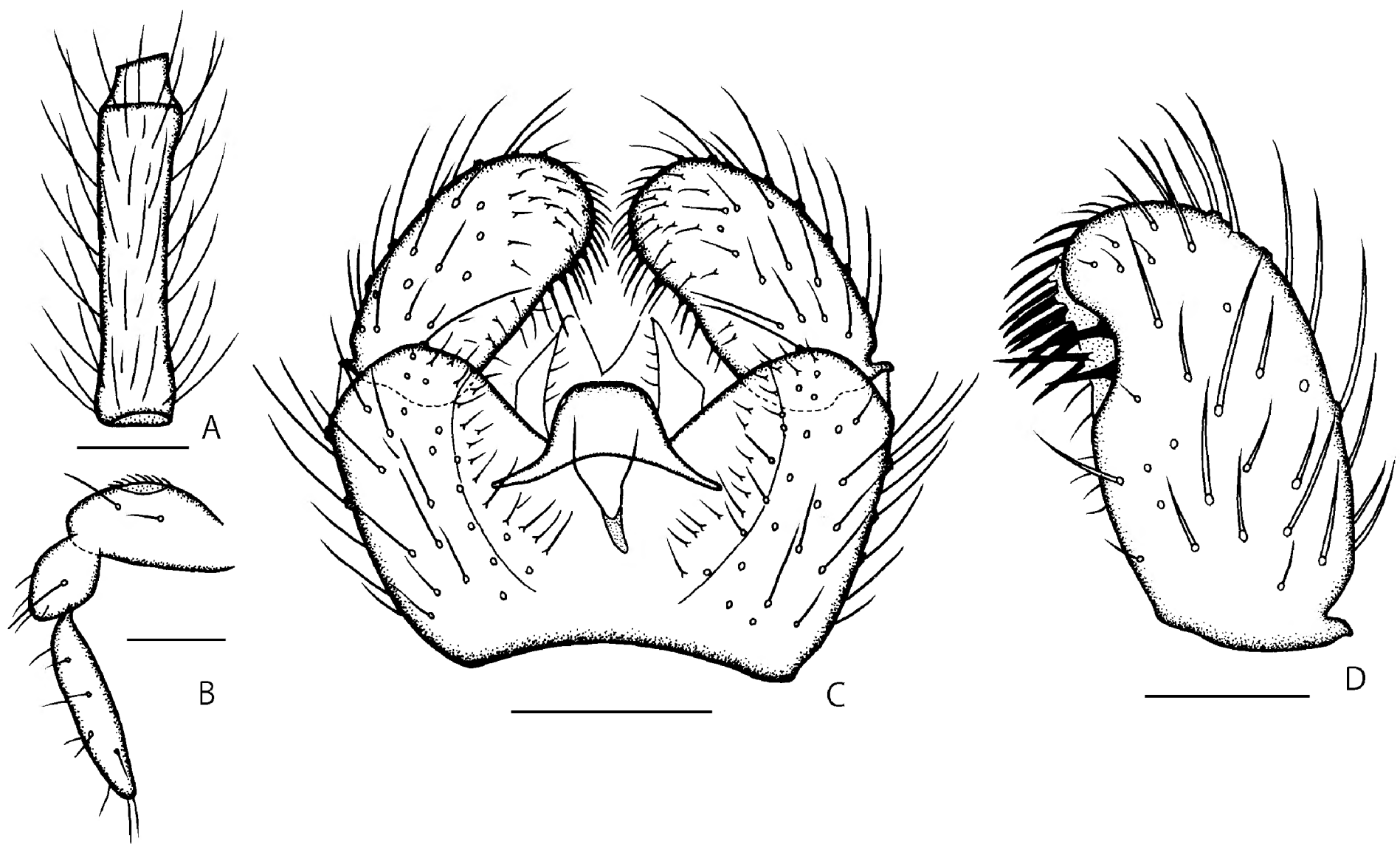


Figure 3. *Trichosia stylofornix* sp. nov., male holotype. **A.** 4th flagellomere; **B.** Left palpus; **C.** Genitalia, ventral view; **D.** Left gonostylus, dorsal view. Scale bars: 0.05 mm (A, B, D); 0.1 mm (C).

***Trichosia (Trichosia) fumoranea* sp. nov.**

<https://zoobank.org/FE3DEE84-DBD2-49F4-A589-455725BC09BF>
Figs 4A, B, 5A–F

Type material. Holotype. JAPAN • ♂; Honshu, Kanagawa Pref., Hakone, Tounomine; 35°14'N, 139°06'E; alt. 250 m; 16 May 2000; M. Sutou leg., sweep-net; NSMT.

Paratypes. JAPAN • 1 ♂ (Fig. 4A); same data as for holotype; SDEI • 1 ♂; Honshu, Kanagawa Pref., Isehara, Mt. Oyama, Shimosya-Miharudai; 35°26'N, 139°14'E; alt. 700 m; 12 June 1993; K. Tsukahara leg.; KPMNH • 1 ♂; Honshu, Kanagawa Pref., Yokohama, Hodogaya, Tokiwadai, evergreen broad-leaved forest dominated by *Castanopsis sieboldii* (site 1); 35°28'19"N, 139°35'13"E; alt. 60 m; 23 Apr. 2007; M. Sutou leg., sweep-net; SDEI • 2 ♂♂; same data but coniferous forest dominated by *Pinus taeda* (site 2); 35°28'15"N, 139°35'34"E; NSMT • 1 ♀; same data (site 1) but 24 Apr. 2001; SDEI • 1 ♀; same data (site 1) but 30 May 2012; NSMT • 2 ♂♂; same data (site 1) but 15 Apr.–9 May 2002; emergence trap; PCMS • 2 ♀♀; same data (site 2) but 7 Apr. 1998; reared from larvae and pupae collected at 29 Mar. 1998; PCMS; 2 male pupae were preserved in ethanol; PCMS.

Description. Male. Head: Eye bridge 3–4 facets wide. Prefrons with setae and clypeus bare. Scape and pedicel brown each with about 6–10 setae; flagellomeres brown except for yellowish base of 1st flagellomere; 4th flagellomere about 3.5–4.0 times as long as wide, neck portion about 1/9 of its whole length (Fig. 5A), hairs yellowish brown and slightly longer than width of flagellomere. Palpus yellowish brown, 3-segmented with length ratio 1.3 : 1.0 : 1.5, 1st segment with 2–5 setae mainly on its outside and without distinct sensory area bearing minute sensilla, 2nd segment with 4–7 setae, 3rd segment slender with 4–8 setae (Fig. 5B). Thorax: Color predominantly dark brown (Fig. 4A); setae on mesonotum and scutellum consist of longer and shorter ones; posterior pronotum bare. Coxae, femora, and tibiae predominantly yellowish brown, tarsi brown (Fig. 4A); middle tibia, hind tibia, and basitarsi of all legs with differentiated spine-like short setae in ground setosity; fore tibial spur about 1.1–1.2 times as long as width of tibial apex (Fig. 5E). Wing with brownish anterior veins and light brownish posterior veins (Fig. 4B); wing membrane fumous, with numerous macrotrichia and minute pits in which base of macrotrichia are embedded (Figs 4B, 5F); R5 with both dorsal and ventral macrotrichia almost along its whole length, bM bare, r-m, M1, M2, stem of M, CuA1, and CuA2 with dorsal macrotrichia; length of R1 = 0.9–1.0 R, c = 0.7–0.8 w, r-m = 0.9–1.8 bM (x), stem of CuA very short, almost absent; R1 ending slightly beyond branching point of M1 and M2; wing length 3.4–3.7 mm. Halter brown, knob and distal 1/4–1/3 of stalk with setae. Abdomen: Tergites and sternites dark brown with dark brownish setae, abdominal segments slender (Fig. 4A). Gonocoxite wider than long (Fig. 5C); gonostylus longer than wide, its inside with a wide lobe on which some spines are present (Fig. 5D); upper half of tegmen nearly

quadrate with two pocket-like structures (Fig. 5C), upper margin of tegmen fringed with fine teeth; aedeagus nearly Y-shaped (Fig. 5C). Body size: 3.5–3.8 mm.

Female. Similar to male, but 4th flagellomere about 3.0 times as long as wide, hairs almost as long as width of flagellomere. Wing length 3.5–3.8 mm. Body size 3.6–4.8 mm.

Remarks. The name of this new species alludes to its blackish body color including fumous wings (Fig. 4). It is so far the only Japanese *Trichosia* species whose wing surface is mostly covered with numerous macrotrichia (Figs 4B, 5F). This character helps in identifying the females of this species. The gonostylus has a wide lobe inside, in which some spines are developed (Fig. 5D). *T. fumoranea* is easily distinguished from previously



Figure 4. *Trichosia fumoranea* sp. nov. **A.** Habitus of male paratype. Genitalia is dissected and is mounted beside the body. **B.** Right wing of male holotype.

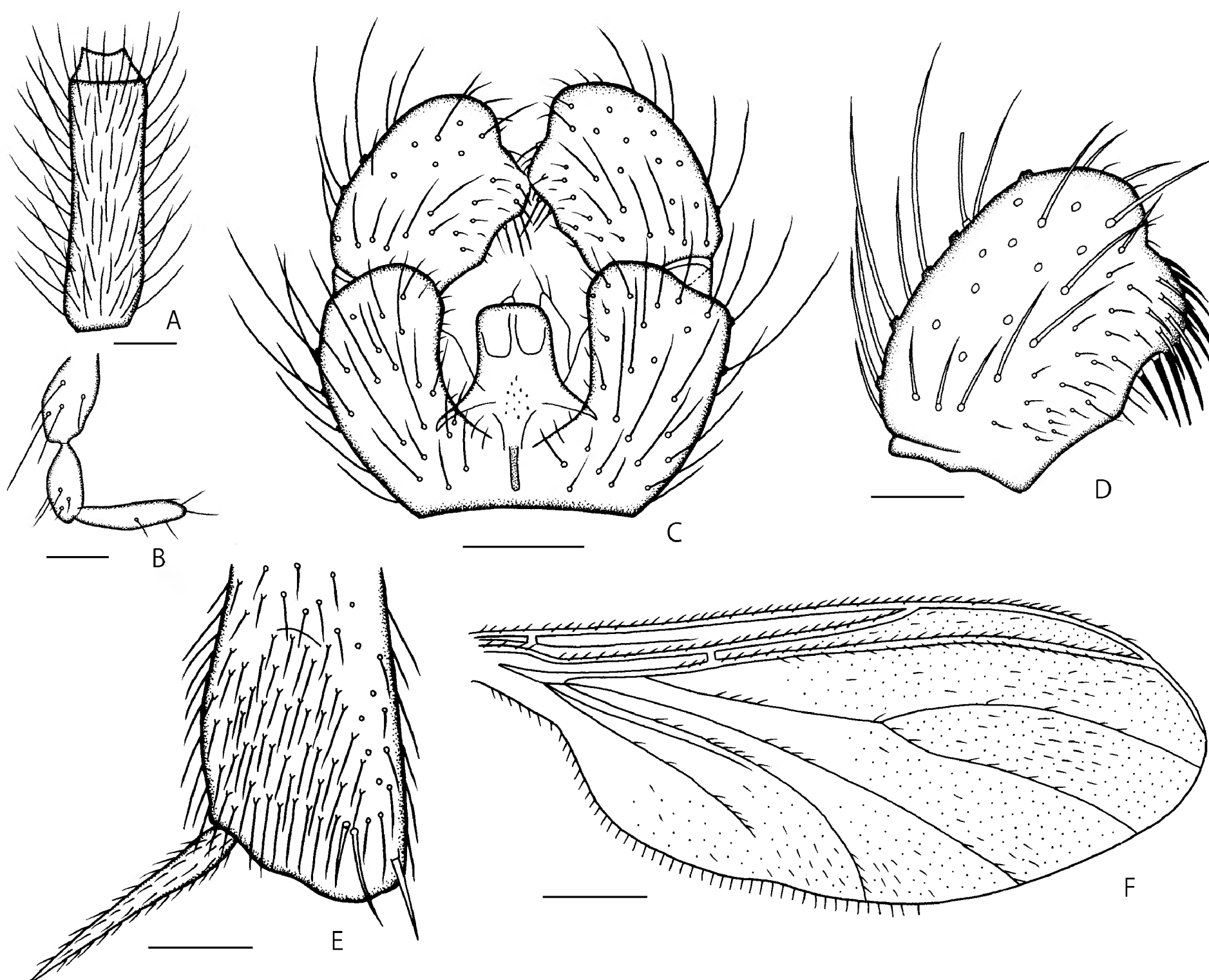


Figure 5. *Trichosia fumoranea* sp. nov., male holotype. **A.** 4th flagellomere; **B.** Right palpus; **C.** Genitalia, ventral view; **D.** Left gonostylus, ventral view; **E.** Inside of left foretibia; **F.** Right wing. Scale bars: 0.05 mm (**A, B, D, E**); 0.1 mm (**C**); 0.5 mm (**F**).

known *Trichosia* species by this character. In 1998, two females of this species were reared from larvae collected from rotten wood. In 2002, two males were collected by emergence traps set on the forest floor. These records suggest that the larvae of this species are xylophagous living in rotten wood and branches on forest floor. Otherwise they may have an intermediate habit between xylophagous and phytosaprophagous.

***Trichosia (Trichosia) basiconstricta* sp. nov.**

<https://zoobank.org/BD89B9F7-69C4-48CF-82D2-F3D0E598507A>

Fig. 6A–D

Type material. *Holotype.* JAPAN • ♂; Honshu, Tokyo, Miyake Island, Hinoyama-touge; 34°06'N, 139°33'E; 5–7 Apr. 2010; J. Aoki leg., flight interception trap; NSMT. *Paratypes.* JAPAN • 3 ♂♂, 2 ♀♀; same data as for holotype; 1 ♂, NSMT; 1 ♂, 1 ♀, SDEI; 1 ♂, 1 ♀, PCMS.

Description. Male. Head: Eye bridge 3–4 facets wide. Prefrons with setae and clypeus bare. Scape brown with about 5 setae anteriorly, pedicel brown with about 8 setae; flagellomeres dark brown except for yellowish brown

base of 1st flagellomere; 4th flagellomere about 3.0–3.5 times as long as wide, neck portion about 1/10 of its whole length (Fig. 6A), hairs yellowish brown and almost as long as width of flagellomere. Palpus brown, 3-segmented with length ratio 1.5 : 1.0 : 1.6, 1st segment with 5–7 setae mainly on its outside and without distinct sensory area bearing minute sensilla, 2nd segment with 6–8 setae, 3rd segment slender with 5–8 setae (Fig. 6B). Thorax: Color predominantly dark brown; dorsocentral setae on mesonotum short, dorsolateral setae on mesonotum and setae on scutellum consist of longer and shorter ones; posterior pronotum with setae. Legs brown; tibiae and basitarsi of all legs with differentiated spine-like short setae in ground setosity; fore tibial spur about 1.1–1.2 times as long as width of tibial apex. Wing with brownish anterior veins and light brownish posterior veins; wing membrane bare; R5 with both dorsal and ventral macrotrichia, bM bare, r-m, M1, M2, stem of M, CuA1, and CuA2 with dorsal macrotrichia; length of R1 = 0.7–0.8 R, c = 0.7 w, r-m = 1.0–1.7 bM, stem of CuA very short, almost absent; R1 ending at same level of or slightly beyond branching point of M1 and M2; wing length 2.9–3.5 mm. Halter brown, knob with setae. Abdomen: Tergites and sternites

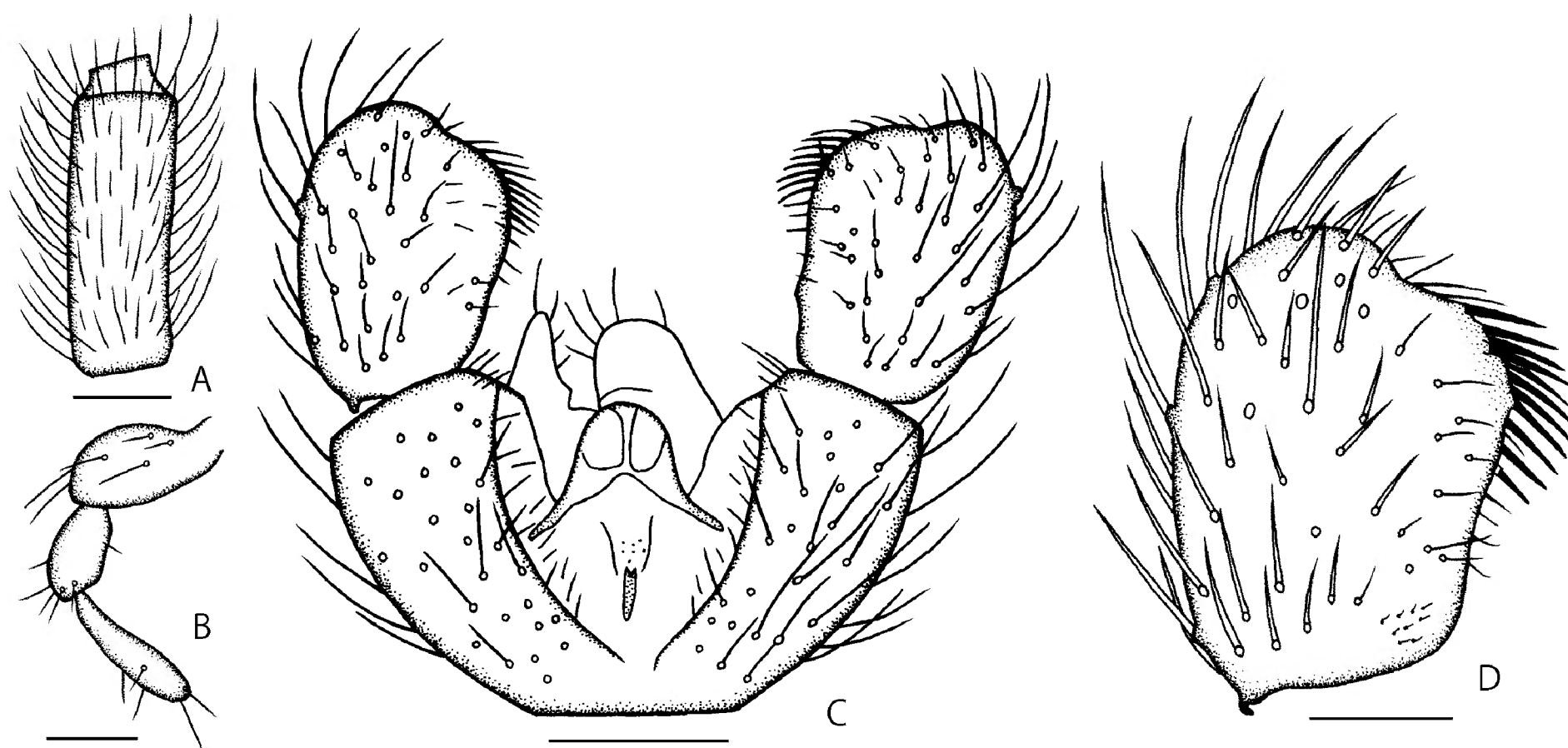


Figure 6. *Trichosia basiconstricta* sp. nov., male holotype. **A.** 4th flagellomere; **B.** Left palpus; **C.** Genitalia, ventral view; **D.** Left gonostylus, ventral view. Scale bars: 0.05 mm (**A, B, D**); 0.1 mm (**C**).

brown with dark brownish setae, membrane between tergites and sternites yellowish brown. Gonocoxite wider than long with narrow base (Fig. 6C); gonostylus longer than wide, its inside moderately swollen on which many spines are present (Fig. 6D); upper half of tegmen rounded with two pocket-like structures (Fig. 6C); aedeagus nearly Y-shaped (Fig. 6C). Body size: 3.6–4.4 mm.

Female. Similar to male, but hairs of 4th flagellomere shorter than its width. Fore tibial spur about 1.3–1.4 times as long as width of tibial apex. Wing length 3.0–3.8 mm. Body size 4.5–5.2 mm.

Remarks. The structure of the gonostylus of this new species (Fig. 6D) resembles that of *T. fumoranea* (Fig. 5D) in having a swollen convexity on which many spines are present. However, this species can be easily distinguished from *T. fumoranea* in having shorter flagellomeres of antennae (Fig. 6A), completely bare wing membrane, constricted base of the gonocoxite (Fig. 6C), and rounded apex of the tegmen (Fig. 6C). The name of this new species is derived from the narrow, constricted base of the gonocoxite. This species is so far known only from Miyake Island, 175 km south of Tokyo metropolis.

Trichosia (Trichosia) conglobata Rudzinski, 2005

Fig. 7A–E

Material examined. JAPAN • 3 ♂♂; Honshu, Miyagi Pref., Sendai, Taihaku, Mukaiyama, mixed forest dominated by *Pinus densiflora*, *Abies firma* and *Quercus serrata*; 38°14'33"N, 140°52'00"E; alt. 70 m; 22 May 2000; M. Sutou leg., sweep-net; SDEI • 4 ♂♂, 2 ♀♀; same data but 14–19 May 2001; reared from larvae and pupae collected at 11 May 2001; 3 ♂♂, 2 ♀♀, NSMT; 1 ♂, MZH; 1 final-instar larva and 2 male pupae were preserved in

ethanol; PCMS • 5 ♂♂, 3 ♀♀; same data but 30 Apr.–29 May 2002; reared from larvae and pupae collected at 28 Apr. 2002; 4 ♂♂, 3 ♀♀, PCMS; 1 ♂, MZH; 19 final-instar larvae, 1 male pupa, and 1 female pupa were preserved in ethanol; PCMS.

Description. Male. See Rudzinski (2005) for a morphological description of the male of this species. Wing length and body size of the specimens examined in this study are 2.5–3.1 mm and 2.6–3.1 mm respectively.

Female. Similar to male, but flagellum of antenna about 0.8 times shorter than that of male. Wing length 2.8–3.2 mm. Body size 3.6–4.0 mm.

Final-instar larva. Head (Fig. 7D, E): Well-chitinized, dark brown. Frontal plate (fp) with 4 pairs of sensory pits (p1–p4), of these, p3 and p4 with very short, minute sensory hair. Gena (ge) with 5 pairs of dorsal sensory pits along marginal suture (p5–p9). Besides them, each gena with 3 dorsolateral, 1 ventrolateral, and 1 ventral sensory pits, of these, anterior dorsolateral pit with minute sensory hair like p3 and p4. Anterior part of head dorsally with labrum (lb), clypeus (cl), and antennal plate (ap), laterally with mandible (md), and ventrally with maxilla and hypopharynx (hp). Maxilla is subdivided into three sclerites, galeolacinia (gl), stipes (st), and cardo (cd); galeolacinia with serrated margin, fused basally with stipes. Thorax and abdomen (Fig. 7C): Body comprises 3 thoracic and 9 abdominal segments. Creamy white in color, but yellowish when alive. Surface smooth without setae, locomotory pad slightly developed ventrally on abdominal segments. Prothoracic and 1st to 7th abdominal segments with spiracles; diameter of prothoracic spiracles larger than that of abdominal ones. Body size: 5.5–9.0 mm.

Pupa. Similar to pupa of *Trichosia pilosa* (currently known as *Leptosciarella pilosa*) figured in Plachter (1979) in having a remarkable process on vertex. The

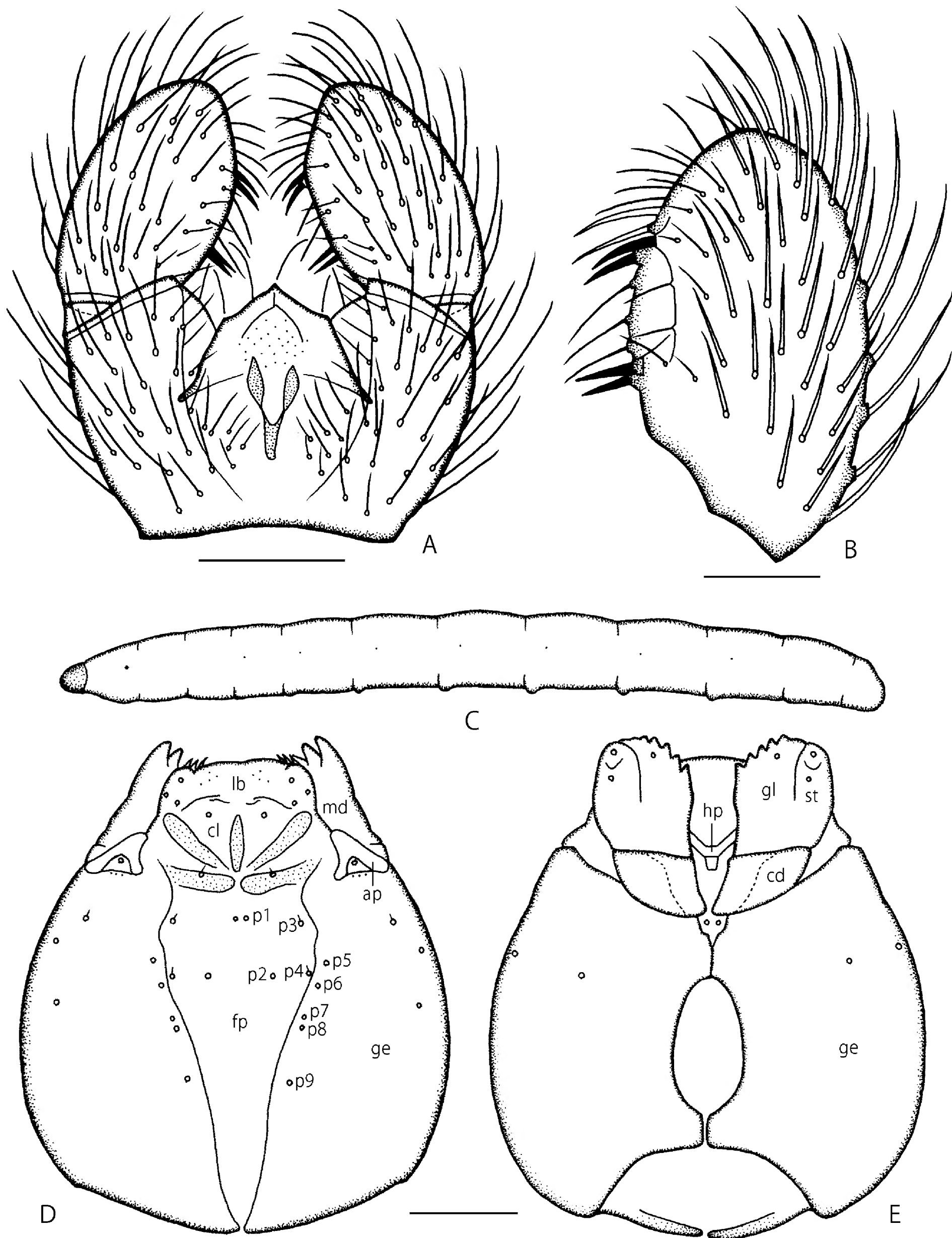


Figure 7. *Trichosia conglobata* Rudzinski. Male adult (A, B) and final-instar larva (C–E). A. Genitalia, ventral view; B. Left gonostylus, dorsal view; C. Habitus; D. Head, dorsal view; E. Head, ventral view. Abbreviations: ap, antennal plate; cd, cardo; cl, clypeus; fp, frontal plate; ge, gena; gl, galeolacinia; hp, hypopharynx; lb, labrum; md, mandible; st, stipes; p1–p9, sensory pits 1–9. Scale bars: 0.1 mm (A, D, E); 0.05 mm (B).

pupa of *T. caudata* also has this characteristic process on vertex (Tuomikoski 1957). Body size: 3.4–4.1 mm.

Remarks. This species was first described in Rudzinski (2005) from Taiwan, and is newly recorded here from Japan. This study found the following two instances of intraspecific morphological variation of this species. According to Rudzinski (2005), the males of this species have the gonostylus with 5 spines which are separated into two groups: 3 spines in the upper group and two in the lower group. Among 12 males from Japan examined in this study, 10 males have the gonostylus with 5 spines like specimens of Taiwan. However, 2 males from Japan have gonostylus with 4 spines (Fig. 7A, B). Another intraspecific variation was found in the thorax. A small sclerite of the thorax called posterior pronotum (frequently abbreviated to ppn) has 4 setae in the specimens of Taiwan. Among the 12 male and 5 female specimens from Japan examined in this study, 2 males and 3 females have posterior pronotum with a few setae, but the posterior pronotum of the others is bare. The female and the immature stages of this species are examined here for the first time. The larvae were collected from rotten wood, so they are xylophagous.

***Trichosia (Trichosia) paraborealis* sp. nov.**

<https://zoobank.org/B7EB53E8-6B3B-48E0-B2E6-9B190C1444CB>

Fig. 8A–D

Type material. Holotype. JAPAN • ♂; Honshu, Miyagi Pref., Sendai, Taihaku, Mukaiyama, mixed forest dominated by *Pinus densiflora*, *Abies firma* and *Quercus serrata*; 38°14'33"N, 140°52'00"E; alt. 70 m; 30 Apr.–23 May 2002; reared from larvae collected at 28 Apr. 2002; M. Sutou leg.; NSMT. **Paratypes.** JAPAN • 1 ♂; Honshu, Tochigi Pref., Nikko, near lake Yuno; 36°48'N, 139°26'E; alt. 1500 m; 18 June 2000; K. Uesugi leg.; SDEI • 2 ♂♂,

5 ♀♀; Honshu, Tokyo, Miyake Island, Hinoyama-touge; 34°06'N, 139°33'E; 5–7 Apr. 2010; J. Aoki leg., flight interception trap; 1 ♂, 2 ♀♀, SDEI; 1 ♂, 1 ♀, PCMS; 2 ♀♀, NSMT.

Description. Male. Head: Eye bridge 4 facets wide. Prefrons with setae, clypeus bare. Scape brown with 2–5 setae, pedicel brown with about 9 setae; flagellomeres brown; 4th flagellomere about 2.5 times as long as wide, neck portion about 1/6 of its whole length (Fig. 8A), hairs yellowish brown and slightly shorter than width of flagellomere. Palpus brown, 2-segmented (holotype) or 3-segmented (paratypes), 1st segment with 1–4 setae and with indistinct sensory area bearing minute sensilla, 2nd and 3rd segments slender with 3–6 setae respectively (Fig. 8B). Thorax: Color predominantly dark brown; mesonotum with both long and short setae; scutellum with some setae, at most 4 of them distinctly longer than the others; posterior pronotum with setae. Legs brown; tibiae and basitarsi with differentiated spine-like short setae in ground setosity; fore tibial spur about 1.3 times as long as width of tibial apex. Wing with brownish anterior veins and light brownish posterior veins; wing membrane bare; distal part of R5 with both dorsal and ventral macrotrichia, bM and stem of M bare, r-m, M1, M2, CuA1, and CuA2 with dorsal macrotrichia; length of R1 = 0.5–0.7 R, c = 0.7 w, r-m = 1.4–1.6 bM but in a paratype from Tochigi r-m = 0.6 bM, stem of CuA very short, almost absent; R1 ending slightly before level of branching point of M1 and M2; wing length 2.2–2.7 mm. Halter brown, knob with setae. Abdomen: Tergites and sternites dark brown with dark brownish setae, membrane between tergites and sternites brown. Gonocoxite wider than long with broad base (Fig. 8C); gonostylus nearly ovoid in shape with 7–9 spines on about upper 2/5 of inside (Fig. 8D); tegmen membranous with sclerotized border, wider than long, minute denticles located on central portion (Fig. 8C); aedeagus distinct and large (Fig. 8C). Body size: 2.3–2.8 mm.

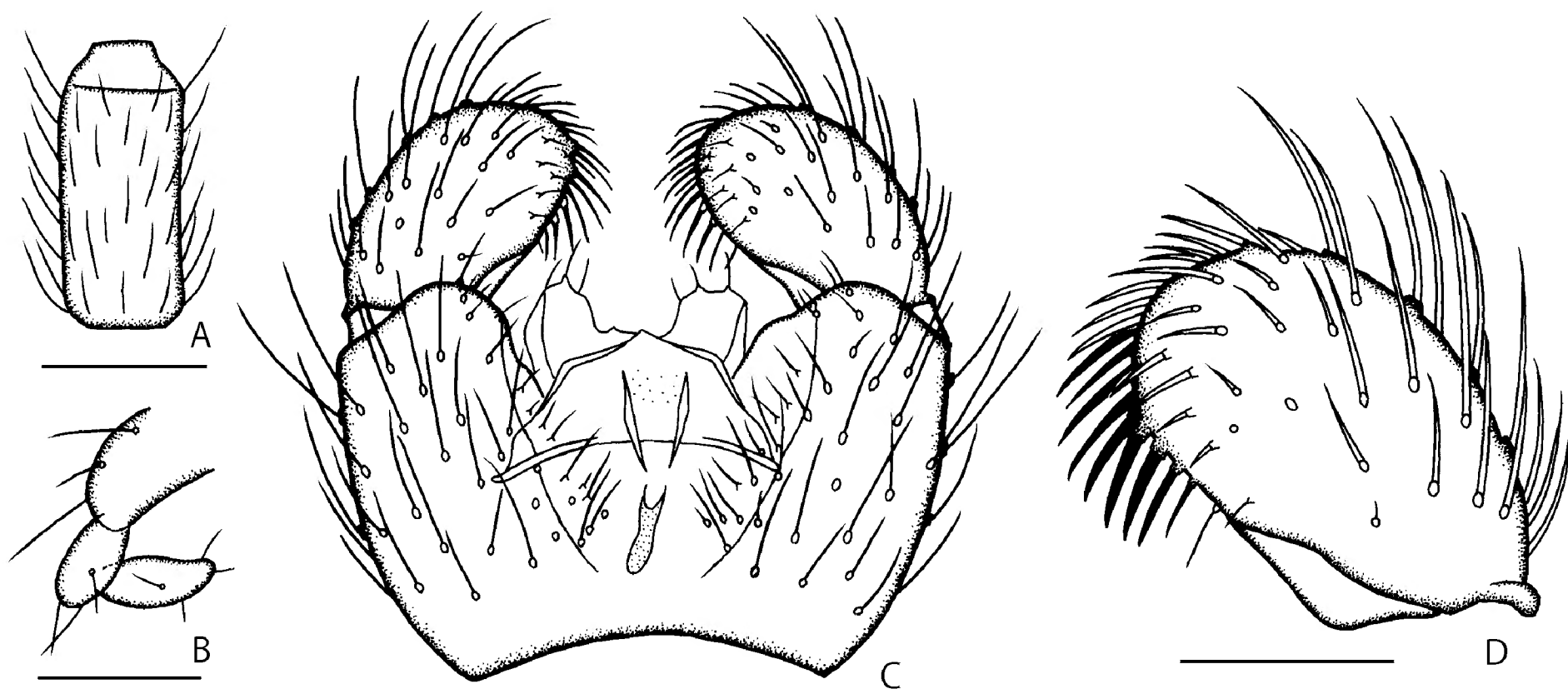


Figure 8. *Trichosia paraborealis* sp. nov., male holotype (A, C, D) and male paratype (B). A. 4th flagellomere; B. Left palpus; C. Genitalia, ventral view; D. Right gonostylus, ventral view. Scale bars: 0.05 mm (A, B, D); 0.1 mm (C).

Female. Same as male except for the following characters: Palpus 3-segmented, but one paratype from Miyake Island (PCMS) asymmetrically with 3-segmented right palpus and 2-segmented left palpus; 1st segment of palpus bare or with a seta. Wing vein r-m = 1.4–1.8 bM; wing length 2.3–2.5 mm. Body size 2.5–3.5 mm.

Remarks. This species is morphologically similar to *T. borealis* (Frey) known from Europe and Russia (Altai). The name of this new species refers to this resemblance. The morphological differences between these two species are in the structure of the male genitalia. The gonostylus of *T. borealis* usually has 6 spines, and the tegmen is about as long as wide (Menzel and Mohrig 1997; Menzel and Mohrig 2000). On the other hand, *T. paraborealis* has the gonostylus with 7–9 longer spines covering upper 2/5 of the inside (Fig. 8D), and the tegmen is wider than long (Fig. 8C). Interestingly, both these species display similar intraspecific morphological variation: they have a 2 or 3-segmented palpus. In addition, length ratio of wing vein r-m and bM is variable in *T. paraborealis*: r-m is shorter than bM in a paratype from Tochigi, inversely, r-m is longer than bM in the others. The holotype of this species is an adult reared from larvae collected from rotten wood, which suggests that the larvae are xylophagous.

***Trichosia (Trichosia) acrotricha* Tuomikoski, 1960**

Material examined. JAPAN • 2 ♂♂; Honshu, Chiba Pref., Sanbu (Sammu); 35°39'N, 140°22'E; alt. 50 m; 18 Apr. 1994; E. Ishitani leg.; 1 ♂, SDEI; 1 ♂, PCMS.

Remarks. This species has been recorded from Europe and Russia (Menzel and Mohrig 1997), and is recorded here from Japan for the first time. While the European specimens of this species have macrotrichia on distal part of the wing membrane, two males from Japan examined in this study are devoid of these macrotrichia. However,

other morphological characters including genitalia of these two males from Japan are identical to those of European specimens.

***Trichosia (Trichosia) comprimera* sp. nov.**

<https://zoobank.org/9CE7CC63-20FD-4C91-92D1-A6D4D3178621>

Fig. 9A–C

Type material. Holotype. JAPAN • ♂; Honshu, Kanagawa Pref., Yamakita, Kiridoshi-touge; 35°25'30"N, 138°55'50"E; alt. 1070 m; 17 May 2008; H. Kawai leg., sweep-net; NSMT.

Description. Male. Head: Eye bridge 3–4 facets wide. Prefrons with setae and clypeus bare. Scape brown with a seta, pedicel brown with about 12 setae; flagellomeres brown; 4th flagellomere 2.1 times as long as wide, neck portion about 1/9 of its whole length (Fig. 9A), hairs yellowish brown and shorter than width of flagellomere. Palpus yellowish brown and 3-segmented; 1st segment with 3–4 setae mainly on its outside and without distinct brownish sensory area, 2nd segment with about 10 setae, 3rd segment slender with 10–12 setae. Length ratio of segments of palpus is unclear because it is preserved obliquely. Thorax: Color predominantly dark brown; setae on mesonotum and scutellum mostly shed off in the holotype; posterior pronotum with setae. Coxae, femora, and tibiae predominantly yellowish brown, tarsi brown; tibiae and basitarsi with differentiated spine-like short setae in ground setosity; fore tibial spur about 1.3 times as long as width of tibial apex. Wing with brownish anterior veins and light brownish posterior veins; wing membrane without macrotrichia; R5 with both dorsal and ventral macrotrichia, bM bare, r-m with 8 dorsal macrotrichia, M1, M2, CuA1, and CuA2 with dorsal macrotrichia, stem of M with about 20 dorsal macrotrichia; length of R1 nearly equal to that of R, c = 0.7 w, r-m = 1.5 bM,

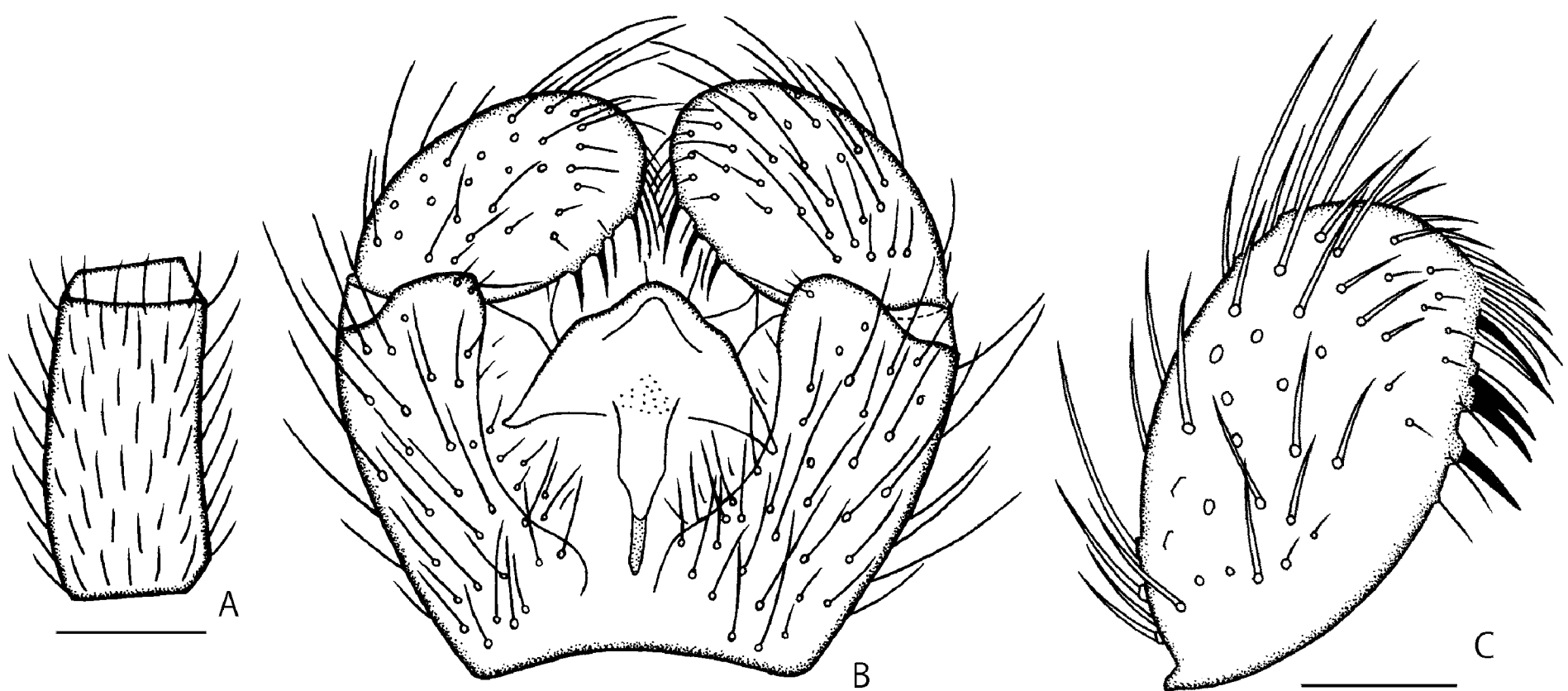


Figure 9. *Trichosia comprimera*, sp. nov., male holotype. A. 4th flagellomere; B. Genitalia, ventral view; C. Left gonostylus, ventral view. Scale bars: 0.05 mm (A, C); 0.1 mm (B).

stem of CuA very short, almost absent; R1 ending slightly beyond level of branching point of M1 and M2; wing length 3.1 mm. Halter yellowish brown, knob with setae. Abdomen: Tergites and sternites brown with dark brownish setae, membrane between tergites and sternites yellowish brown. Gonocoxite wider than long (Fig. 9B); gonostylus nearly ovoid in shape with 5 spines and with dense setae above uppermost spine (Fig. 9C), two lowest spines overlap at same level and look like one spine from ventral view; tegmen nearly triangular with minute denticles on lower part (Fig. 9B); aedeagus Y-shaped with dark brownish base (Fig. 9B). Body size: 3.6 mm.

Female. Unknown.

Remarks. This new species resembles *T. lengersdorfi* and *T. edwardsi*, but is distinguished from them by smaller body size, short flagellomeres (Fig. 9A), and dense and long setae on the upper part of the inside of the gonostylus (Fig. 9C). The name *comprimera* alludes to these dense (compressed) setae.

Trichosia (Trichosia) caudata (Walker, 1848)

Material examined. JAPAN • 1 ♂; Honshu, Hyogo Pref., Yabu, Mt. Hyounosen, mixed forest dominated by *Fagus crenata* and bamboo grasses; 35°21'N, 134°31'E; alt. 1200 m; 28 Sept. 1995; M. Jaschhof and T. Yagi leg., sweep-net; SDEI.

Remarks. *Trichosia caudata* was originally described by Fabricius (1794) in the fly genus *Rhagio* (Rhagionidae) and later classified by himself as '*Sciara morio*' in the family Sciaridae (Fabricius 1805). Heller et al. (2016) found that the female lectotype of *Rhagio morio* Fabricius belongs to *Sciara hemerobioides* Scopoli, 1763, so that the name *Rhagio morio* Fabricius sank into synonymy and the next available name, '*caudata* Walker, 1848', was reinstated for this *Trichosia* species. *Trichosia caudata* (Walker) is common and widespread in Europe (Menzel and Mohrig 1997), but has only rarely been found in East Asia. Sasakawa (1993, 2003, 2014) recorded an adult specimen from Japan as '*Bradysia morio*' (1993) and '*Trichosia morio*' (2003, 2014) which visited a *Naematoloma* mushroom in Kyoto Prefecture. In this study, we examined one male collected in Hyogo Prefecture.

Trichosia (Trichosia) lengersdorfi Heller, Köhler & Menzel, 2016

Material examined. JAPAN • 1 ♂; Honshu, Hyogo Pref., Yabu, Mt. Hyounosen, mixed forest dominated by *Fagus crenata* and bamboo grasses; 35°21'N, 134°31'E; alt. 1200 m; 28 Sept. 1995; M. Jaschhof and T. Yagi leg., sweep-net; SDEI.

Remarks. This species is known from Europe and China (Heller et al. 2016), and is recorded here from Japan for the first time. This species resembles *T. caudata*, but is distinguished from it by the condition of

macrotrichia on wing membrane and the characters of the male gonostylus (see key to the Japanese species). A male of *T. lengersdorfi* and a male of *T. caudata* were collected sympatrically in this study.

Trichosia (Trichosia) hypertricha Menzel & Mohrig, 1997

Material examined. JAPAN • 2 ♂♂; Hokkaido, Sapporo, Hyakumatsu-sawa; 43°01'N, 141°13'E; alt. 500 m; 5 Aug. 1998; K. Mizota leg.; 1 ♂, SDEI; 1 ♂, PCMS • 1 ♂, dried specimen; Hokkaido, Chitose, near lake Shikotsu; 20 July 2000; K. Uesugi leg.; PCMS • 1 ♂, 1 ♀; Honshu, Yamagata Pref., Yamagata, Omosiroyama; 38°20'N, 140°30'E; alt. 550 m; 19 Aug. 2001; M. Sutou leg., sweep-net; PCMS.

Remarks. This species has been recorded from Russia (Menzel and Mohrig 1997), and is recorded here from Japan for the first time. It is similar to *T. caudata* and their morphological differences were explained in the original description of *T. hypertricha* (Menzel and Mohrig 1997). While the specimens of this species from Russia have macrotrichia on about distal 2/3 of the wing membrane, the specimens from Japan have the macrotrichia restricted to the distal half of the wing membrane. *T. hypertricha* usually has 3-segmented palpi, but a male collected in Sapporo (PCMS) has asymmetrically a 3-segmented right palpus and 2-segmented left palpus.

Trichosia (Trichosia) edwardsi (Lengersdorf, 1930)

Material examined. JAPAN • 1 ♂, dried specimen; Honshu, Kanagawa Pref., Yamakita, Nishi-Tanzawa, Higasisawa-rindou; 35°28'43"N, 139°05'10"E; alt. 950 m; 2 June 1995; H. Watari leg.; KPMNH • 3 ♂♂, 1 ♀; Kyushu, Fukuoka Pref., Fukuoka, Mt. Sefuri; 33°27'N, 130°22'E; alt. 500 m; 20–22 Apr. 1999; S. Sato leg., Malaise trap; 1 ♂, 1 ♀, PCMS; 1 ♂, NSMT; 1 ♂, SDEI • 1 ♂; Kyushu, Kagoshima Pref., Yusui, Kurino; 31°58'N, 130°48'E; alt. 600 m; 17 Mar. 1999; reared from larvae and pupae collected at 8 Mar. 1999; M. Sutou leg.; PCMS; 1 female pupa was preserved in ethanol; PCMS • 1 ♂, 1 ♀; Kyushu, Kagoshima Pref., Uchinoura, Mt. Hoyoshi; 31°15'N, 131°00'E; alt. 700 m; 28 Apr. 2000; M. Sutou leg., sweep-net; PCMS.

Remarks. This species is known from Europe (Menzel and Heller 2006), and is recorded here from Japan for the first time. This species is similar to *T. caudata* and *T. lengersdorfi*, and the morphological differences among these species are summarized in a key to the Japanese species presented above. Heller et al. (2016) regarded *T. edwardsi* and some morphologically similar species as *T. edwardsi* species complex, and showed that DNA barcoding was helpful for classifying it. Among the specimens of *T. edwardsi* examined in this study, one male from Kagoshima was reared from larvae and pupae collected from rotten wood.



Figure 10. *Trichosia montaclaria* sp. nov., male holotype. **A.** 4th flagellomere; **B.** Left palpus; **C.** Genitalia, ventral view; **D.** Left gonostylus, ventral view. Scale bars: 0.05 mm (**A**, **B**, **D**); 0.1 mm (**C**).

***Trichosia (Trichosia) montaclaria* sp. nov.**

<https://zoobank.org/E7726F1D-B5A8-4102-8CCF-1B703FBA8B32>

Fig. 10A–D

Type material. Holotype. JAPAN • ♂; Honshu, Yamanashi Pref., Kosu, Hikawa-rindou; 35°42'35"N, 138°49'42"E; alt. 1350 m; 26 June 2007; H. Kawai leg., sweep-net; NSMT.

Description. Male. Head: Eye bridge 4–5 facets wide. Prefrons with setae and clypeus bare. Scape brown with 3 setae, pedicel brown with about 8 setae; flagellomeres brown; 4th flagellomere 3.5 times as long as wide, neck portion about 1/13 of its whole length (Fig. 10A), hairs yellowish brown and slightly shorter than width of flagellomere. Palpus brown, 3-segmented with length ratio 1.5 : 1.0 : 2.3, 1st segment with 7 setae and with indistinct sensory area bearing minute sensilla, 2nd segment with 9 setae, 3rd segment slender with 8 setae (Fig. 10B). Thorax: Color predominantly dark brown; setae on mesonotum and scutellum consist of longer and shorter ones, scutellum with 5 long setae; posterior pronotum with setae. Legs predominantly brown; tibiae and basitarsi with differentiated spine-like short setae in ground setosity; fore tibial spur about 1.3 times as long as width of tibial apex. Wing with brownish anterior veins and light brownish posterior veins; wing membrane without macrotrichia but a macrotrichium is seen between M1 and M2 of left wing; R5 and M1 with both dorsal and ventral macrotrichia, bM with 3 dorsal macrotrichia, r-m with 7 dorsal macrotrichia, M2, CuA1, and CuA2 with dorsal macrotrichia, stem of M with 14–15 dorsal macrotrichia; length of R1 = 1.2 R, c = 0.7 w, r-m = 1.0 bM, stem of CuA very short, almost absent; R1 ending slightly beyond level of branching point of M1 and M2;

wing length 4.0 mm. Halter brown, knob and distal 1/3 of stalk with setae. Abdomen: Tergites and sternites dark brown with dense dark brownish setae. Gonocoxite wider than long with U-shaped cleft in base (Fig. 10C); gonostylus pyriform, left gonostylus with 6 spines and right gonostylus with 7 spines inside, 2 spines directed downward compared to the other ones (Fig. 10D); tegmen nearly triangular but with arcuate base, and with rounded membranous appendage on upper portion (Fig. 10C); aedeagus located beneath tegmen (Fig. 10C). Body size: 3.9 mm.

Female. Unknown.

Remarks. This new species resembles Palearctic *T. edwardsi* and Nearctic *T. cylindrica*, but is distinguished from them by the shorter and more closely arranged spines of the gonostylus (Fig. 10D). The clearly bordered U-shaped cleft of the base of the gonocoxite is also characteristic for this species (Fig. 10C). Only one male of this species was collected at a high altitude locality (1350 m). The name of this new species is derived from the montane habitat where it was collected and its clear (bare) wing membrane contrasting with the dark brownish body.

Updated checklist of the *Mouffetina* and *Trichosia* species of the world

Taxonomic note: Shin et al. (2019) raised *Mouffetina* Frey, 1942 to the genus rank based on molecular markers and discussed only the type species *Mouffetina pulchricornis* (Edwards) and an unidentified *Mouffetina* sp. from South Korea in their study. All other known *Mouffetina* species, which were grouped together into a subgenus “*Trichosia (Mouffetina)*” by Menzel and Mohrig (2000), Mohrig and

Röschmann (2005) and Mohrig et al. (2013) based on morphological characters, were not considered in this correction of systematic rank. For the above reasons, the nomenclatural act required to maintain a uniform classification system of Sciaridae is implemented in the following checklist. The same procedure is applied to *Baeosciara involuta* and *B. scotica* ssp. *macrotricha*, which were described from Taiwan by Rudzinski (2005). In contrast to his original description, we do not consider the taxon “*macrotricha* Rudzinski” as a subspecies, but elevate it to the rank of a species. *Trichosia* (*Leptosciarella*) *incomposita* Mamaev, 2001 described from Russia belongs also to *Trichosia* Winnertz on the basis of the original description and not to the genus *Leptosciarella* Tuomikoski. The intergeneric position of this species cannot be determined at present due to the outstanding holotype revision. The two species *T. calcarata* Mohrig & Mamaev and *T. silvicola* Mohrig & Mamaev cannot be placed in any of the known subgenera either, as they were described in female sex only (Mohrig and Mamaev 1970) and no further material has been found to date. For these reasons, these three Palaearctic species are summarized in the category ‘Unplaced in *Trichosia*’.

Abbreviations: **SG** = subgenus; [=] = synonym name; * = fossil in Dominican, Baltic or Saxonian amber; **preocc.** = preoccupied name; **comb. nov.** = new combination; **s. str.** = sensu stricto; **sp. nov.** = new species; **stat. nov.** = new status.

***Mouffetina* Frey, 1942**

M. duopalpus Sutou & Menzel, sp. nov.

M. expolita (Coquillett, 1900), comb. nov.

= *M. abdita* (Johannsen, 1912)

= *M. clavata* (Garrett, 1925)

= *M. filispina* Menzel & Mohrig, 1997

M. gryptostyla Mohrig & Röschmann, 1997, comb. nov.

M. nova Mohrig & Röschmann, 2005 *, comb. nov.

M. pulchricornis (Edwards, 1925)

M. silvestris (Mohrig & Antonova, 1978), comb. nov.

***Trichosia* Winnertz, 1867**

SG *Archaeosciara* Mohrig & Röschmann, 1994 *

T. ruebsaamenia (Meunier, 1904) *

= *T. robusta* (Meunier, 1904) [preocc.] *

T. venohirsuta Röschmann & Mohrig, 1995 *

SG *Baeosciara* Tuomikoski, 1960

T. discolor (Lengersdorf, 1928)

= *T. pusillima* (Frey, 1942)

T. involuta (Rudzinski, 2005), comb. nov.

T. macrotricha (Rudzinski, 2005), stat. et comb. nov.

T. pectinata (Vilkamaa, 2003)

T. scotica (Edwards, 1925)

= *T. arcuata* (Garrett, 1925)

= *T. diderma* (Garrett, 1925)

T. sinuata Menzel & Mohrig, 1997

SG *Palaeotrichosia* Mohrig & Röschmann, 1994 *

T. diabolica (Meunier, 1904) *

T. errans (Meunier, 1904) *

T. kedingi Röschmann & Mohrig, 1995 *

T. preciosa (Meunier, 1904) *

T. resinae Röschmann & Mohrig, 1995 *

T. voelsgeni Röschmann & Mohrig, 1995 *

SG *Trichosia* Winnertz, 1867 s. str.

T. acrotricha Tuomikoski, 1960

T. basdeni Freeman, 1983

T. basiconstricta Sutou & Menzel, sp. nov.

T. borealis (Frey, 1942)

T. caudata (Walker, 1848)

= *T. dziedzickii* (Grzegorzec, 1884)

= *T. longiventris* (Zetterstedt, 1851)

= *T. mikii* (Grzegorzec, 1884)

= *T. sznablii* (Grzegorzec, 1884)

T. comprimera Sutou & Menzel, sp. nov.

T. confusa Menzel & Mohrig, 1997

T. conglobata Rudzinski, 2005

T. controversa Rudzinski, 2005

T. cylindrica (Petty, 1918)

T. diota (Garrett, 1925)

T. edwardsi (Lengersdorf, 1930)

T. flavicoxa Tuomikoski, 1960

T. fumoranea Sutou & Menzel, sp. nov.

T. glabra (Meigen, 1830)

T. gravitata Rudzinski, 2005

T. habilis (Johannsen, 1912)

= *T. globosa* (Petty, 1918)

T. hypertricha Menzel & Mohrig, 1997

T. jenkinsoni Freeman, 1987

T. lengersdorfi Heller, Köhler & Menzel, 2016

T. meunieri (Cockerell, 1910) *

= *T. prolifica* (Meunier, 1904) [preocc.] *

T. montaclaria Sutou & Menzel, sp. nov.

T. morosa Rudzinski, 2005

T. paraborealis Sutou & Menzel, sp. nov.

T. pseudoussurica Mohrig & Krivosheina, 1979

T. splendens Winnertz, 1867

= *T. maxima* Strobl, 1880

= *T. winnertzi* Nowicki, 1868

T. stylofornix Sutou & Menzel, sp. nov.

T. townesi (Shaw, 1935)

T. trichata Menzel & Mohrig, 1997

T. ussurica Mohrig & Antonova, 1978

T. vicina (Johannsen, 1912)

Unplaced in *Trichosia*

T. calcarata Mohrig & Mamaev, 1970

T. incomposita Mamaev, 2001

T. silvicola Mohrig & Mamaev, 1970

Discussion

The distribution ranges of each of the 14 Japanese species of *Mouffetina* and *Trichosia* studied here are as follows: Holarctic and Taiwan (*T. scotica*), Palaearctic (*T. acrotricha*, *T. caudata*, *T. lengersdorfi* and *T. edwardsi*), Russia and Japan (*T. hypertricha*), Japan and Taiwan (*T. conglobata*), and only in Japan (seven new species described above). Mohrig et al. (2013) recorded eight species of *Trichosia* from the Nearctic region and noted that four of them have a Holarctic distribution. Of these Holarctic species, only *T. scotica* is recorded here from Japan. In this study, we show that each species of Japanese *Trichosia* displays more or less intraspecific morphological variation. The condition of the macrotrichia on the wing membrane is one of the important characters for identifying the specimens of this genus. However, we found that this character is geographically variable in *T. acrotricha* and *T. hypertricha*. The specimens of these species collected in Japan have fewer macrotrichia on the wing membrane compared to those collected in Europe or Russia. We also found that the number of segments of the palpus is variable in *T. paraborealis* and *T. hypertricha*; the specimens of these species examined here have a 3- or 2-segmented palpus. Even in the male genitalia, slight intraspecific morphological variations were observed in *T. scotica* and *T. conglobata*. See description and remarks on each species for details of the intraspecific morphological variation. In contrast to intraspecific variation, remarkable interspecific morphological differences can be found in the figured characters such as flagellomeres of antenna, palpus, wing, and the male genitalia. Of these, the male genitalia possess the most important diagnostic characters. Accordingly, we constructed the key to the Japanese species mainly based on the characters of the male genitalia. Including new species described here, 44 extant and 10 fossil species of *Mouffetina* and *Trichosia* are known worldwide (see the updated checklist).

The larval morphology of *Trichosia* is described here for the first time (Fig. 7C–E). The larvae of two species of black fungus gnats *Scythropochroa radialis* and *Ctenosciara japonica* were previously described in a similar way (Sutou and Ito 2004; Sutou et al. 2007). The larvae of these three genera are morphologically similar. In particular, they have nine pairs of sensory pits on the dorsal surface of the head (Fig. 7D, p1–p9). However, the arrangement of these sensory pits is different among these genera. For example, p3 is located at nearly the same level as p1 in *T. conglobata*, but p3 is posterior to p1 in *S. radialis* and *C. japonica*; similarly, p4 is located at nearly the same level as p2 in *T. conglobata*, but p4 is posterior to p2 in the other two species. Furthermore, p6 is posterior to p4 in *T. conglobata* and *S. radialis*, but p6 is anterior to p4 in *C. japonica*. In addition, the larva of *T. conglobata* is distinguished in having p3 and p4 with minute sensory hairs (Fig. 7D) compared to the bare p3 and p4 of *S. radialis* and *C. japonica*. Recently, Menzel et al. (2024) described p1–p9 on the head of the Neotropical sciarid fly *Pseudolycoriella hygida*

(Saugaia & Alves). Shin et al. (2013) classified larval habitats of Sciaridae using the categories rotten wood, plant litter, and living plants. The main larval habitat of *Trichosia* is rotten wood (Menzel et al. 2006; Shin et al. 2013). Among the 13 species of *Trichosia* studied here, some adults of *T. fumoranea*, *T. paraborealis*, *T. conglobata*, and *T. edwardsi* were obtained by rearing larvae or pupae collected from rotten wood. Thus we confirmed that the larvae of this genus are mainly xylophagous.

Acknowledgements

We thank the following people for offering us the specimens, Jun-ichi Aoki (Tokyo), Eiji Ishitani (Chiba Prefecture Forestry Research Institute), Mathias Jaschhof (Färjestaden, Sweden), Hideki Kawai (University of Tokyo), Koji Mizota (Hokkaido University), Shinsuke Sato (Kyushu University), Kenta Uesugi (Hokkaido University). The institutional affiliations of these contributors were current when we received the specimens. We also thank Andrew Liston (SDEI) for improving English. MS thanks Masatoshi Takakuwa and Haruki Karube (KPMNH) for permission to examine the specimens deposited at the museum. MS also thanks Kai Heller (Heikendorf, Germany) for offering the European specimens for comparison. M. Takakuwa passed away in 2016, and J. Aoki passed away in 2022. MS thanks them for their support through the years.

References

- Arthofer W, Gollner A, Heller K, Steiner FM, Schlick-Steiner BC, Seeber J (2021) Contribution to the molecular phylogeny of Sciaridae (Diptera) with special attention to the genera *Bradysia* and *Corynoptera*. *Zootaxa* 4951: 391–400. <https://doi.org/10.11646/zootaxa.4951.2.12>
- Coquillett DW (1910) The type-species of the North American genera of Diptera. *Proceedings of the United States National Museum* 37: 499–647. <https://doi.org/10.5479/si.00963801.37-1719.499>
- Edwards FW (1925) XXII. British fungus-gnats (Diptera, Mycetophilidae). With a revised generic classification of the family. *Transactions of the Entomological Society of London* 72(1924): 505–670. <https://doi.org/10.1111/j.1365-2311.1925.tb03369.x>
- Fabricius JC (1794) *Entomologia systematica emendata et aucta. Secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus*. Tomus 4. Impensis C. G. Proft, Hafniae [Christian Gottlieb Proft, Copenhagen], 472 pp. + 11 pp. [unpaginated]
- Fabricius JC (1805) *Systema antliatorum secundum ordines, genera, species adiectis synonymis locis, observationibus, descriptionibus*. Apud Carolum Reichhard, Brunsvigae [Carl Reichard, Braunschweig], 372 pp. + 11 pp. [unpaginated] <https://doi.org/10.5962/bhl.title.15806>
- Heller K, Köhler A, Menzel F, Olsen KM, Gammelmo Ø (2016) Two formerly unrecognized species of Sciaridae (Diptera) revealed by DNA barcoding. *Norwegian Journal of Entomology* 63: 96–115.

- Irmeler U, Heller K, Warning J (1996) Age and tree species as factors influencing the populations of insects living in dead wood (Coleoptera, Diptera: Sciaridae, Mycetophilidae). *Pedobiologia* 40: 134–148. [https://doi.org/10.1016/S0031-4056\(24\)00347-0](https://doi.org/10.1016/S0031-4056(24)00347-0)
- Lengersdorf F (1928–1930) 7. Lycoriidae (Sciaridae). In: Lindner E (Ed.) *Die Fliegen der palaearktischen Region, Band 2.1* (Lieferung 24, 43). E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, 71 pp. [+ 4 plates]
- Mamaev BM (2001) New species of gall midges and sciarids (Diptera: Cecidomyiidae, Sciaridae) in high level tundra of North Ural. *Publications of the All-Russian Institute for Advanced Training of Managers and Forestry Specialists* 16: 1–12. [In Russian]
- Menzel F, Mohrig W (1997) Revision der paläarktischen Arten von *Trichosia* Winnertz sensu Tuomikoski, 1960 (Diptera, Sciaridae). – Teil I. Gattung *Trichosia* Winnertz, 1867. *Studia dipterologica* 4: 3–40.
- Menzel F, Mohrig W (2000) Revision der paläarktischen Trauermücken (Diptera: Sciaridae). *Studia dipterologica Supplement* 6(1999): 1–761.
- Menzel F, Heller K (2006) Trauermücken (Diptera: Sciaridae) aus dem Nationalpark “Hainich” (Thüringen) nebst der Beschreibung von *Scatopsciara andrei* Menzel spec. nov. *Studia dipterologica* 13: 45–59.
- Menzel F, Schulz U (2007) Die Trauermücken in Deutschland – ökosystemare Bedeutung, zöologische Koinzidenzen und bioindikatorisches Potential (Diptera: Sciaridae). *Beiträge zur Entomologie* 57: 9–36. <https://doi.org/10.21248/contrib.entomol.57.1.9-36>
- Menzel F, Smith JE, Chandler PJ (2006) The sciarid fauna of the British Isles (Diptera: Sciaridae), including descriptions of six new species. *Zoological Journal of the Linnean Society* 146: 1–147. <https://doi.org/10.1111/j.1096-3642.2006.00190.x>
- Menzel F, Gammelmo Ø, Olsen KM, Köhler A (2020) The black fungus gnats (Diptera, Sciaridae) of Norway – Part I: species records published until December 2019, with an updated checklist. *ZooKeys* 957: 17–104. <https://doi.org/10.3897/zookeys.957.46528>
- Menzel F, Kramp K, Amorim DS, Gorab E, Uliana JVC, Sauaia H, Monesi N (2024) *Pseudolycoriella hygida* (Sauaia and Alves) – An overview of a model organism in genetics, with new aspects in morphology and systematics. *Insects* 15: 118. <https://doi.org/10.3390/insects15020118>
- Mohrig W, Mamaev B (1970) Zur Kenntnis flügelreduzierter Dipteren der Bodenstreu. II. Beitrag. Gattung *Bradysia*, *Corynoptera*, *Lycoriella* und *Trichosia* (Sciaridae). *Zoologischer Anzeiger* 184: 349–359.
- Mohrig W, Menzel F (1997) Revision der paläarktischen Arten von *Trichosia* Winnertz sensu Tuomikoski, 1960 (Diptera, Sciaridae). – Teil II. Gattungen *Leptosciarella* Tuomikoski, 1960 und *Trichodapus* gen. nov. *Studia dipterologica* 4: 41–98.
- Mohrig W, Röschmann F (2005) Sciarid flies from Dominican Amber (Diptera, Sciaridae). *Beiträge zur Entomologie* 55: 319–361. <https://doi.org/10.21248/contrib.entomol.55.2.319-361>
- Mohrig W, Heller K, Hippa H, Vilkamaa P, Menzel F (2013) Revision of the black fungus gnats (Diptera: Sciaridae) of North America. *Studia dipterologica* 19(2012): 141–286.
- Plachter H (1979) Zur Kenntnis der Präimaginalstadien der Pilzmücken (Diptera, Mycetophiloidea). Teil III: Die Puppen. *Zoologische Jahrbücher, Abteilung für Anatomie und Ontogenie der Tiere* 101: 427–455.
- Rudzinski HG (2005) Beitrag zur Trauermückenfauna Taiwans Teil II: Gattungen *Sciara*, *Schwenckfeldina*, *Trichosia*, *Leptosciarella*, *Baeosciara* und *Trichosillana* gen. nov. (Diptera Nematocera: Sciaridae). *Entomofauna* 26: 253–280.
- Sasakawa M (1993) Japanese mushroom gnats (Diptera: Sciaridae). *Japanese Journal of Environmental Entomology and Zoology* 5: 1–5. (In Japanese)
- Sasakawa M (2003) Notes on the Japanese Diptera Part 2. *Japanese Journal of Entomology New Series* 6: 119–133. [In Japanese]
- Sasakawa M (2014) Family Sciaridae. In: The Editorial Committee of Catalogue of the Insects of Japan (Eds) *Catalogue of the Insects of Japan, Volume 8 Diptera, Part 1 Nematocera–Brachycera Aschiza*. Touka Shobo, Fukuoka, 114–125. [In Japanese]
- Shin S, Jung S, Menzel F, Heller K, Lee H, Lee S (2013) Molecular phylogeny of black fungus gnats (Diptera: Sciaroidea: Sciaridae) and the evolution of larval habitats. *Molecular Phylogenetics and Evolution* 66: 833–846. <https://doi.org/10.1016/j.ympev.2012.11.008>
- Shin S, Lee H, Lee S (2019) Proposal of a new subfamily of Sciaridae (Diptera: Sciaridae), with description of one new species from South Korea. *Zootaxa* 4543: 127–136. <https://doi.org/10.11646/zootaxa.4543.1.8>
- Suetsugu K, Sueyoshi M (2018) Subterranean flowers of *Aspidistra elatior* are mainly pollinated by not terrestrial amphipods but fungus gnats. *Ecology* 99: 244–246. <https://doi.org/10.1002/ecy.2021>
- Sutou M, Ito MT (2004) Occurrence of the genus *Scythropochroa* (Insecta: Diptera: Sciaridae) in Japan, with descriptions of the female and larva. *Species Diversity* 9: 375–381. <https://doi.org/10.12782/specdiv.9.375>
- Sutou M, Kato T, Ito M (2007) Description of the final larval stage and the pupa of *Ctenosciara japonica* (Diptera: Sciaridae) and their DNA barcodes. *Studia dipterologica* 14: 17–22.
- Tuomikoski R (1957) Beobachtungen über einige Sciariden (Dipt.), deren Larven in faulem Holz oder unter der Rinde abgestorbener Bäume leben. *Annales Entomologici Fennici* 23: 3–35.
- Tuomikoski R (1960) Zur Kenntnis der Sciariden (Dipt.) Finnlands. *Annales Zoologici Societatis Zoologicae Botanicae Fennicae ‘Vanamo’* 21: 1–164.
- Vilkamäa P (2003) Review of the genus *Baeosciara* Tuomikoski (Diptera: Sciaridae). *Entomologica Fennica* 14: 220–226. <https://doi.org/10.33338/ef.84190>
- Vilkamäa P, Komonen A (2001) Redescription and biology of *Trichosia* (*Baeosciara*) *sinuata* Menzel & Mohrig (Diptera: Sciaridae). *Entomologica Fennica* 12: 46–49. <https://doi.org/10.33338/ef.84095>
- Vilkamäa P, Salmela J, Hippa H (2007) Black fungus-gnats in deciduous forest habitat in northern Europe, with the description of *Bradysia arcuata* sp. n. (Diptera: Sciaridae). *Entomologica Fennica* 18: 226–231. <https://doi.org/10.33338/ef.84403>
- Vilkamäa P, Rudzinski HG, Burdiková N, Ševčík J (2018) Phylogenetic position of *Aerumnosa* Mohrig (Diptera, Sciaridae) as revealed by multigene analysis, with the description of four new Oriental species. *Zootaxa* 4399: 248–260. <https://doi.org/10.11646/zootaxa.4399.2.8>
- Vilkamäa P, Burdiková N, Ševčík J (2023) The genus *Spinopygina* gen. nov. (Diptera, Sciaridae) from Western North America: Preliminary molecular phylogeny and description of seven new species. *Insects* 14: 173. <https://doi.org/10.3390/insects14020173>
- Walker F (1848) List of the specimens of dipterous insects in the collection of the British Museum. Part I. Trustees of the British Museum, London, 229 pp.
- Winnertz J (1867) Beitrag zu einer Monographie der Sciarinen. W. Braumüller, Wien, 187 pp.